

Cartographical support of socio-economical development in Arctic region of Russia

Belousov S.K.

Lomonosov Moscow State University, Moscow, Russian Federation

Abstract. The methodological approach to classify regions in socio-economic aspect of Russian Arctic has been developed. Various indices of sustainable socio-economic development have been suggested to detect most problems aspects of development. A series of analytic maps of indices and synthetic map of classification have been developed.

Keywords: Sustainable development, Indices, Russian Arctic

1. Introduction

Russia in its historical development has always been closely linked to the Arctic. Today, the Arctic remains one of the most important parts in the strategic policy of Russia. The document "Principles of State Policy of the Russian Federation in the Arctic for the period up to 2020 and beyond" The Arctic is defined as a strategic resource base for economic and social development of the country, as well as a zone of peace and cooperation. On this evidence, the creation of Arctic administration information systems becomes necessary task.

Cartographic method of research is one of the most effective methods of territory assessment, so mapping support is a mandatory part of the project of area development. Index calculating is one of the simplest and at the same time effective way to assess the territory using mapping equipment.

In this paper, we consider the most preferred options of the socio-economic development that could be applied according to the socio-economic situation in the region. But this does not mean that other factors must not be taken into account. A comparative analysis of the socio-economic situation is impossible without taking into account the natural and environmental factors

2. Indices of socio-economic development

2.1. Methodology of calculating indices

Socio-economic development is extremely multifaceted in nature. It depends on a complex of factors. These factors can be grouped in various ways. We offer the following classifications: Social factors, Economic Factors, Environmental factors, Political Factors. These factors largely overlap, but it is inevitable. Let's try to assess their applicability for comparative analysis of socio-economic development.

Political factors are difficult to estimate numerically on the basis of objective data. It is possible only on the basis of expert analysis of the current political situation in the region, of federal policy trends, etc.

Group of economic factors is a major one, as they determine the level of financial investment required for the development of regions. In addition, economic factors determine the major trend of development, because economic benefits are essential causes to the development of new areas.

Social factors are important for any region, especially for the Arctic region, which environment is very harsh. Russian Arctic is settled slightly and irregularly. There is a shortage of labor, especially skilled, for the implementation of new projects. Therefore, the conditions of life in the region are so important.

Environmental factors are taken into account in the practice of territory development in Russia recently. But every year they take more and more importance. This is especially actually for the Arctic areas due to their high vulnerability to economic activity.

Indicators of the investment climate regions and the index of economic sustainability of the region were selected to take into account economic factors.

Investment climate determines the attractiveness of the region for companies to invest in its economy. This indicator is a key to social and economic development, because Russia is a country with a market economy, and the percentage of private investment is quite high. The investment climate is made up of two parts: the investment attractiveness and investment risks.

The calculation of the investment climate was based on the methodology of rating agency "Expert". According to this methodology assessing the investment attractiveness was made using 9 sets of factors: human, financial, industrial, consumer, institutional, infrastructure, natural resource, tourism, innovation. Statistical data of Federal Service of State Statistics of Russia and expertise for indicators that can not be estimated with the help of statistical data was used as the input data. For each group of factors nor-

malized to the maximum and minimum values of the index were calculated. Integral index was calculated using the weights determined by the expert. Investment risk was assessed according to five groups of parameters: economic, social, administrative, environmental, criminal. Integral index of investment risk is calculated similarly to the index of investment attractiveness.

Index of economic sustainability describes the ability of society as much as it possible to meet their own material and non-material needs, including long-term needs. In our opinion this indicator is the characterizes the level of economic development to the best advantage, because development in modern conditions must satisfy the requirements of sustainability.

The methodology of Rubanov and Tikunov was chosen as the basis for the calculation of the index of economic stability. The gross regional product per capita was used as a key measure, adjusted for the value of natural resource depletion and environmental pollution. Index was also adjusted on the index of income inequality - the Gini coefficient. More than that, the coefficients on the percentage of the mining and manufacturing industries in the GRP was included into calculations. For the mining industry used weights were smaller than for manufacturing one due to low stability of extractive industries. Index was normalized by extremely large and extremely low values of contemporary society using logarithms.

Social factors were taken into account with a well-known index of human development and social sustainability indicators territory – the coefficient “Human welfare” and index “Demography and Health”.

The human development index was calculated according to the UN method in 2011. Key figures of calculations are life expectancy, education and standard of living.

Indicators of social stability of territory were calculated according to the methodology of Rubanov and Tikunov. Index “Demography and Health” was calculated according to statistics for 2010, the key figures used in the calculations are: birth rates, population growth, the ratio of marriage and divorce, life expectancy, alcohol and drug abuse, crime and murder rate. For the coefficient “Human welfare” the main indicators are unemployment, wages, the number of people with low incomes, infant mortality.

Environmental factors were taken into account with index of environmental sustainability, developed by Rubanov and Tikunov. The index takes into account indicators of environment conditions, such as the lithosphere, hydrosphere, atmosphere and biosphere.

2.2. Analysis of indices

Index of investment attractiveness is extremely various. It differs from the high values of 0.71 in Yamalo Nenets autonomous okrug to extremely low 0.33 in Komi republic. Moreover, the number of regions with low values prevail over high ones. This claims that the Russian Arctic as a whole has developed quite weak, although there are objective reasons for the interest of the investors.

Index of investment risk was even more various than the last one. It ranges from 0.15 to 0.85. But most of the values still do not exceed the value of 0.5. This means that the overall level of the processes that impede the flow of capital is not so great, but much depends on the particular region (fig. 1). For most regions attractiveness exceeds the risk, which is a positive factor for development (fig.2).

Index of economic stability is high for all regions (from 0.55 to 0.83). This fact is quite surprising because there is mostly extensive type of industrial development. These high values can be explained by the low number of people and huge amount of various natural resources (fig 3.).

Index "Demography and Health" for almost all of regions is much lower than the Russian average level (from 0.27 to 0.49). This could be easily explained by history of the development of the Arctic region of Russia during the Soviet period as a raw material appendage, followed by decline in the 90-s. XX century. Against the backdrop of the economic crisis there were not free resources to support social infrastructure of subsidized regions, and their single-minded focus specialization did not contribute cash flow (fig 4).

The index "Human welfare" is also below the national average (from 0.65 to 0.83). The reasons are basically the same as in the previous paragraph. But the scale of the disaster is not as large as there. In recent years, the mining industry in the north grew rapidly, and financial incentives for the population when very weak social infrastructure took place was essential term to attract qualified staff from other regions (fig 5).

Ecological Sustainability Index, in contrast, for all regions above its average for Russia (from 0.77-0.86). It could be explained by weak level of economic development in huge territories (fig. 6).

Region	Investment attractiveness	Investment risks	Index of economical sustainability	Index "Demography and health"
Chukotka autonomous okrug	0,54	0,68	0,83	0,27
Sakha republic	0,38	0,85	0,64	0,48
Taimyr Dolgoano-Nenets district	0,43	0,35	0,62	0,39

Yamalo-Nenets autonomous okrug	0,71	0,47	0,82	0,49
Nenets autonomous okrug	0,39	0,15	0,95	0,39
Komi republic	0,33	0,66	0,64	0,33
Arkhangelsk oblast	0,4	0,3	0,62	0,38
Karelia republic	0,41	0,33	0,55	0,33
Murmansk oblast	0,65	0,34	0,62	0,32

Table 1. Indices of Russian Arctic regions. Part 1.

Region	Index "Human welfare:	Index of ecological sustainability	Human development index
Chukotka autonomous okrug	0,65	0,83	0,8
Sakha republic	0,68	0,83	0,83
Taimyr Dolgoano-Nenets district	0,67	0,84	0,83
Yamalo-Nenets autonomous okrug	0,83	0,86	0,88
Nenets autonomous okrug	0,75	0,82	0,82
Komi republic	0,76	0,82	0,83
Arkhangelsk oblast	0,69	0,8	0,82
Karelia republic	0,72	0,84	0,8
Murmansk oblast	0,73	0,77	0,81

Table 2. Indices of Russian Arctic regions. Part 2.

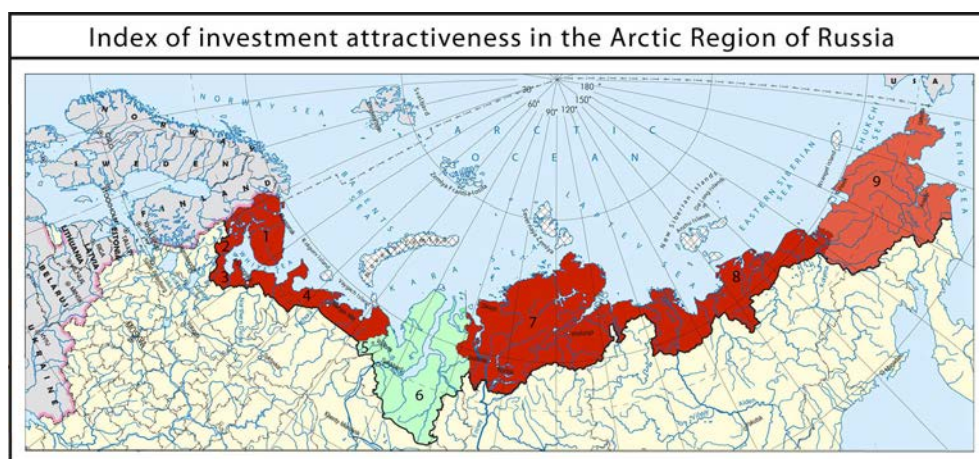


Figure 1. Index of investment attractiveness.

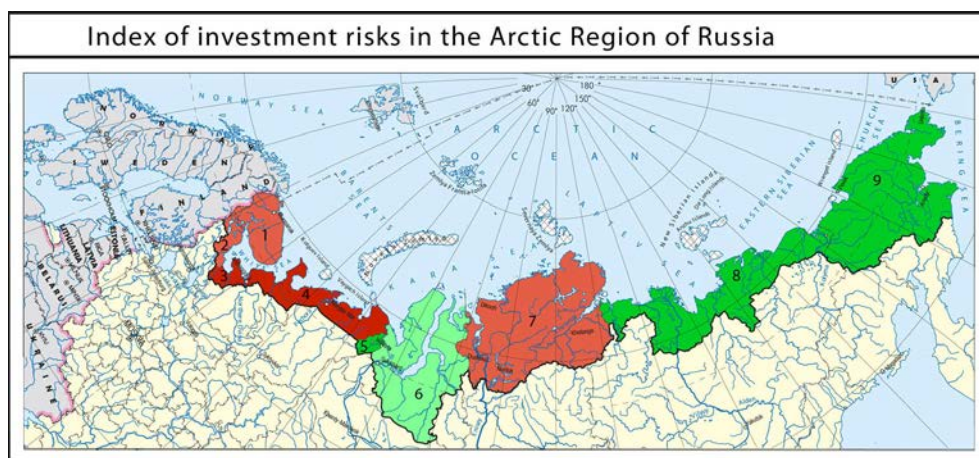


Figure 2. Index of investment risks.

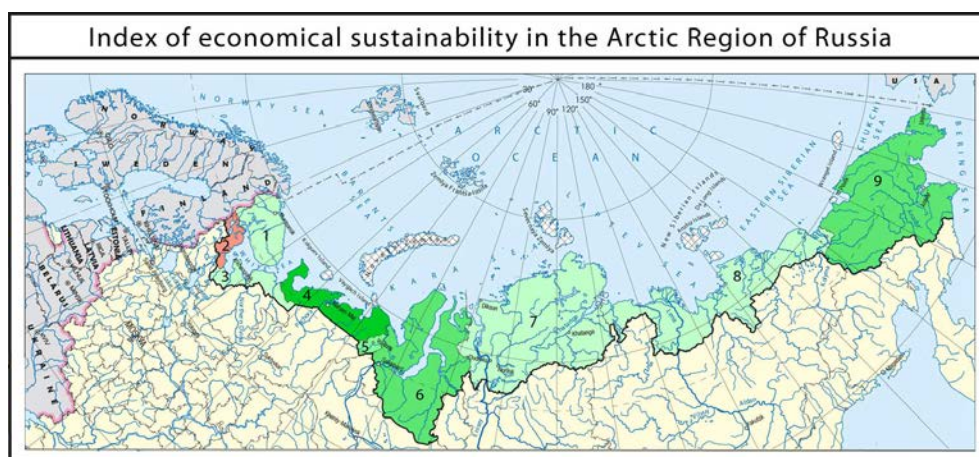


Figure 3. Index of economical sustainability.

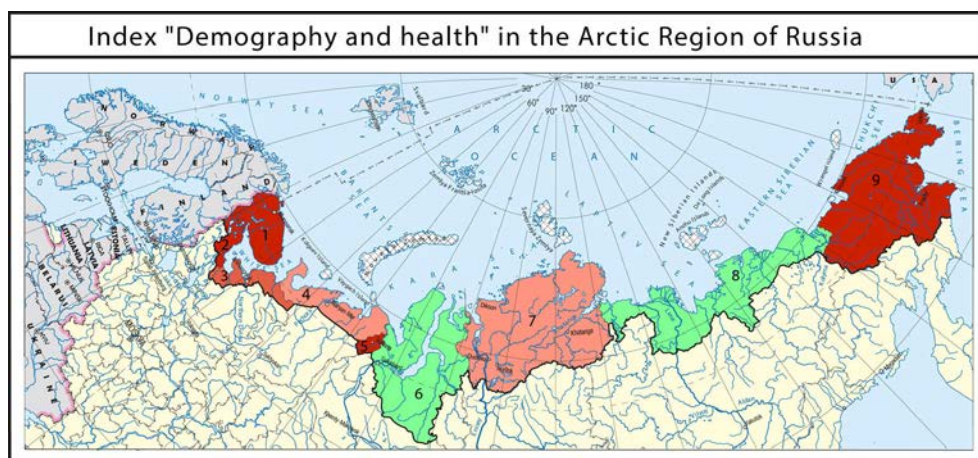


Figure 4. Index "Demography and Health".

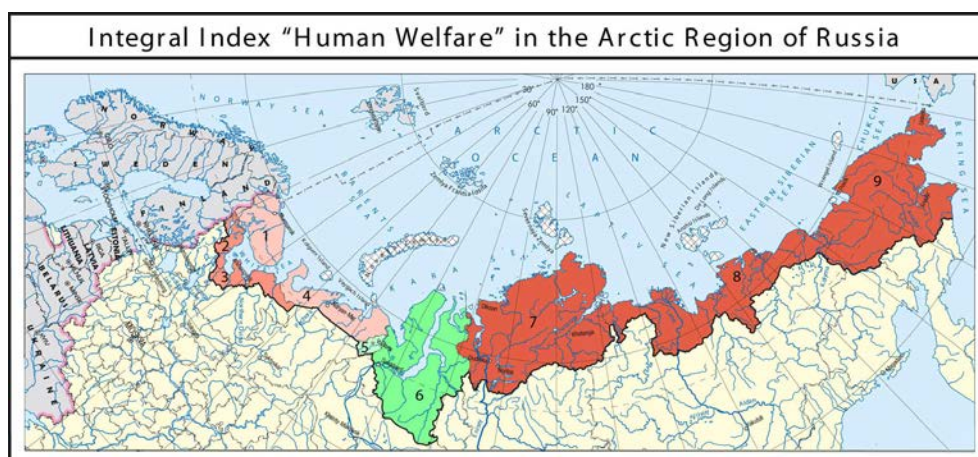


Figure 5. Index "Human Welfare".



Figure 6. Index of ecological sustainability.

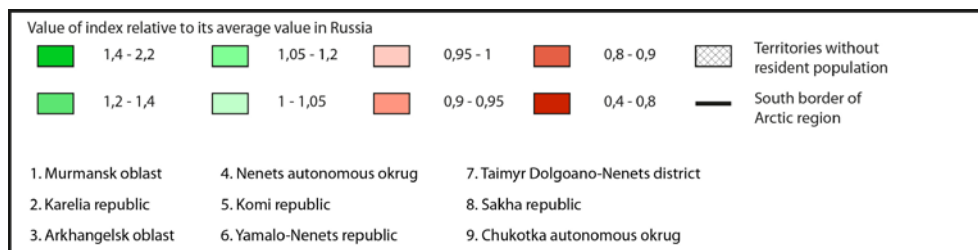


Figure 7. Legend to figures 1-6.

3. Cluster analysis

We used the method of cluster analysis to determine areas that are similar to each other by a set of parameters. The most suitable method was selected method K-means clustering to identify clusters by the method of Cartesian distance. By analysis of the results were selected 4 clusters (fig. 8-9).

The first cluster contains the following regions: Chukotka autonomous okrug, Sakha republic, Komi republic. Cluster unites mostly eastern regions of the Russian Arctic, which don't make large-scale production of fossil fuels, and its social and economic infrastructure is in decline. These regions are characterized by the excess of investment risks to attractiveness. Consequently, the socio-economic development is possible only with the direct involvement of the state. Distinguishing characteristic of these regions is relatively high level of economic sustainability, which suggests that their long-term development will be useful both for the region and for Russia as a

whole. This cluster could be described as underdeveloped investment unattractive regions that require active government involvement in the development of transport, industrial and social infrastructure.

The second, the most numerous cluster consists of Taimyr Dolgano-Nenets district of Krasnoyarsk krai, Arkhangelsk oblast, Karelia republic, Murmansk oblast. It includes mainly the regions located in the west of the territory (Taimyr Dolgano-Nenets district is an exception). These are regions with a relatively high level of industrial and social development, which are in a decline. However, the development of economic and transport infrastructure here is quite high. Taimyr Dolgano-Nenets district is here due to the presence of Norilsk industrial hub, the largest in the Russian North. Cluster is characterized by a minor (except for Murmansk oblast) excess of investment attractiveness to the risk, and their absolute values are not so high. This shows the relative development of the industry, however, there is no extraordinary reasons to invest a lot of money here for private investors. Index of economic sustainability is consistently low. This tells us about the long history of industrial development of the area, about the fact that many deposit fields developed significantly and the level of environmental impact of enterprises on the environment is great. Social indexes are not much lower than in other regions, which tells us about the long stagnation in the social sector of the economy in the region. This all can be described as a cluster of investment-attractive regions with average level of industrial development, with high problems of social and environmental issues that require state participation in the development of social infrastructure, as well as in the regulation of environmental impacts.

The third cluster consists of one region - Yamalo Nenets autonomous okrug. It is a region of active mineral extraction. In the last few decades a lot of natural gas field have been developed. It is one of the most financially-secured regions of the Arctic. Cluster is characterized by a significant excess of the investment attractiveness to the risk, coupled with their large absolute values. Index of economic sustainability is also high, due to higher revenue from gas production. Social and environmental indices are high too due to the relatively recent and rapid development of gas industry. This allows us to characterize cluster as a very attractive investment and weak economically diversified regions with high levels of human development, which requires state participation in the diversification of the economic infrastructure and in the regulation of environmental impacts.

The fourth cluster also consists of one region - Nenets autonomous okrug. It is a region of active natural gas and oil extraction. It is also one of the most financially-secured regions of the Arctic. The region is characterized by extreme values of economic stability and investment risks. Economic stability

is very high, and the investment risk is extremely small. This indicates good conditions for the development of the region, indicates that the development is active, but began recently. The value of social indices comparable with regions from the second cluster, which means that the social infrastructure needs to be improved. This cluster could be described as a cluster of investment-attractive, weak economically diversified region with an average level of social infrastructure, which requires state participation in the development of social, transport infrastructure and in the diversification of the economic infrastructure.

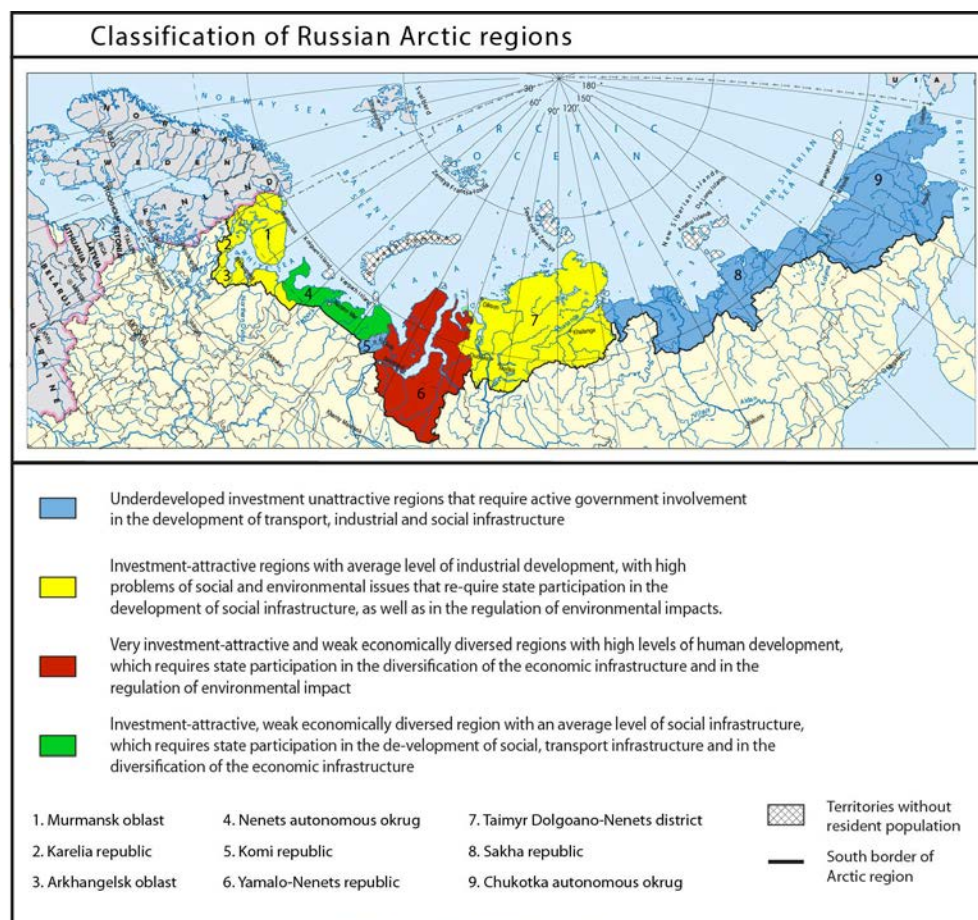


Figure 8. Classification of Russian Arctic regions

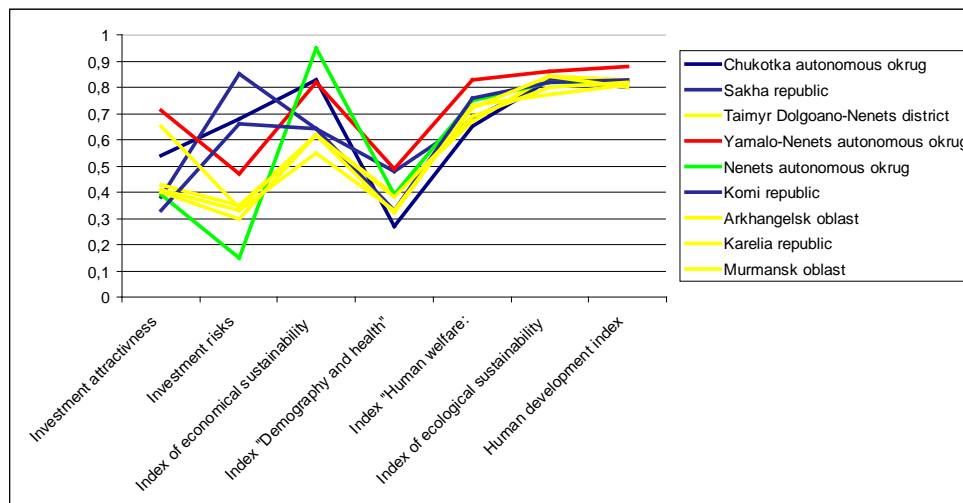


Figure 9. Results of cluster analysis.

4. Conclusion

The proposed methodology is designed specially to the Arctic region of Russia and can describe complex regions in terms of socio-economic development, and identify the most problematic aspects of development that need priority support from the state.

The maps, which characterize the investment attractiveness indices, economic, social and environmental sustainability, and human development index, were created.

The method of cluster analysis identified four types of regions by the combination of proposed indexes. A synthetic map was created, in which the regions are characterized by terms of their socio-economic development and the by priority of the ways of the development.

References

- Alekseevskiy N.A., Belousov S.K., Dobrolubov S.A., Magritskiy D.V., Nokelainen T.S., Tikunov V.S. Atlas "Russian Arctic in XXI century: natural challenges and risks of development. – Materials of international conference "Sustainable development of territories: GIS theory and practical experience", InterCarto-InterGIS – 19, Kursk, Bogota, 2013, p. 3-14.

- Bobylev S.N., Minakov S.V., Solovyeva S.V., Tretyakov V.V. Ecologo-economic index of Russian regions. – Moscow.:WWF Russia, «РИА Новости (RIA News)», 2012. – 147 p.
- Grishina I.V. Analysis and prediction of investment processes in Russian regions. – Moscow.: «СОПС (SOPS)», 2005.
- Grishina I.V. Methodology of complex analysis of investment processes in Russian regions // Russian investments. – 2005. - №4.
- How index of investment attractiveness is being made // Expert. – 2011. - №50 (783).
- Indicators of sustainable development of Russia (economic-ecological aspects). / Under the editorship of S.N. Bobylev, P.A. Makeenko. – Moscow.:ЦППП (CPRP), 2001. – 220 p.
- Principles of State Policy of the Russian Federation in the Arctic for the period up to 2020 and beyond. Moscow, 2008.
- Rubanov I.N., Tikunov V.S. Assessment of economical sustainability of Russian regions. – Materials of international conference “Sustainable development of territories: GIS theory and practical experience”, InterCarto-InterGIS – 15, Perm, Gent, 2009, p. 3-11.
- Rubanov I.N., Tikunov V.S. Assessment of social sustainability of Russian regions. – Materials of international conference “Sustainable development of territories: GIS theory and practical experience”, InterCarto-InterGIS – 12, Kaliningrad, Berlin, 2006, p. 96-113.
- Rubanov I.N., Tikunov V.S. Methodology of Assessment of ecological sustainability and natural conditions in Russia. – Materials of international conference “Sustainable development of territories: GIS theory and practical experience”, InterCarto-InterGIS – 11, Stavropol, Dombai, Budapest, 2005, p. 206-214.
- Rubanov I.N., Tikunov V.S. Sustainability of Russian regions: integral assessment. – Materials of international conference “Sustainable development of territories: Geographical herald, Perm, 2006, №3(11), p. 69-76.